CLAIMS

1. A silicon implant having a beneficial substance associated with it, the implant being eroded when implanted in a mammalian body.

2. A silicon implant according to claim 1 in which the implant comprises porous silicon.

3. A silicon implant according to claim 1 which comprises polycrystalline silicon.

4. A silicon implant according to claim 1 ~~any preceding claim~~ which is resorbed when implanted in a mammalian body.

5. A silicon implant according to claim 1 ~~any preceding claim~~ which if left in the mammalian body for long enough is substantially completely resorbed.

6. A silicon implant according to claim 1 ~~any preceding claim~~ in which said beneficial substance comprises an element of the periodic table.

7. A silicon implant according to claim 6 in which the element is a micromineral.

8. A silicon implant according to claim 7 in which the micromineral is from the group: selenium, manganese, molybdenum, chromium, vanadium, iodine, fluorine, cobalt (vitamin B12).

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9. A silicon implant according to claim 6 in which the element is an essential trace element identified as such in Figure 5.

omnibus

10. A silicon implant according to claim 6 in which the element is a therapeutic element.

11. A silicon implant according to claim 10 in which the element is from the group consist of: lithium, gold, silver, platinum.

12. A silicon implant according to ~~any preceding claim~~ Claim 1 in which the substance is distributed through a volume of the material of said implant.

13. A silicon implant according to claim 11 in which the substance is distributed through substantially the whole volume of the material of the implant.

14. A silicon implant according to ~~any preceding claim~~ Claim 1 which comprises at least a region of porous silicon.

15. A silicon implant according to claim 14 which comprises substantially entirely porous silicon.

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16. A silicon implant according to claim 14 ~~or claim 15~~ which has a porosity of at least 3%, 4% or 5%. Markush, [illegible]

17. A silicon implant according to ~~any one of claims 14 to 15~~ Claim 14 which has a porosity of 30% or less.

18. A silicon implant according to ~~any one of claims 14 to 16~~ Claim 14 which has a porosity in the range 3% to 10%, or in the range 10% to 60%.

19. A silicon implant according to ~~any preceding claim~~ Claim 1 in which there is provided a reservoir of beneficial substance. and a door leading to the

reservoir, the door being made of silicon material which is corroded in use so as to enable body fluid to contact the beneficial substance in the reservoir.

20. A silicon implant according to claim 19 in which there are a plurality of reservoirs.

21. A silicon implant according to claim 19 ~~or claim 20~~ in which the reservoirs are adapted to expose or release their contents to body fluids sequentially with time.

22. A silicon implant according to claim 19 ~~any one of claims 19 to 21~~ in which there are a plurality of reservoirs, each having an associated door, and in which there are doors of different corrosion times, such that in use the reservoirs are breached at different times.

23. A silicon implant according to claim 22 in which there are doors of different thicknesses.

24. A silicon implant according to claim 22 in which there are doors which corrode at different rates.

25. A silicon implant according to claim 19 ~~any one of claims 19 to 24~~ in which there is an array of reservoirs.

26. A silicon implant according to claim 19 ~~any one of claims 19 to 25~~ in which the reservoirs comprise holes which contain the beneficial substance.

27. A silicon implant according to claim 19 ~~any one of claims 19 to 25~~ in which the reservoirs comprise regions of the implants which differentially contain

the beneficial substance to a significantly higher level than adjacent, non-reservoir, regions of the implant.

claim 19

28. A silicon implant according to ~~any one of claims 19 to 27~~ which comprises a first component defining in part a boundary of the or each reservoir and a second component defining in part a boundary of the or each reservoir.

29. A silicon implant according to claim 28 in which the two components are substantially the same.

claim 19

30. A silicon implant according to ~~any one of claims 19 to 29~~ in which there are at least of the order of ten, and preferably at least of the order of a hundred, reservoirs.

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31. A silicon implant according to claim 30 in which there are at least or the order of a thousand reservoirs.

claim 19

32. A silicon implant according to ~~any one of claims 19 to 31~~ that has been micromachined.

33. An implant comprising a porous or polycrystalline carrier material that is corrode by mammalian subcutaneous physiological fluids, and a beneficial substance associated with the carrier material.

34. An implant according to claim 33 in which the carrier material is a semiconductor.

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35. An implant according to claim 34 in which the carrier material is from the doped or undoped group: silicon, germanium. silicon carbide, silicon nitride.

36. An implant according to claim 33 ~~any one of claims 33 to 35~~ in which the implant comprises porous or polycrystalline semiconductor material.

37. An implant according to claim 33 ~~any one of claims 33 to 36~~ in which the beneficial substance comprises an element of the period table.

38. An implant according to claim 36 in which the element is a micromineral.

39. An implant according to claim 36 and ~~any one of claims 1 to 35~~ in which instead of silicon another semiconductor material comprises the material that is eroded in use.

40. A silicon implant substantially as described herein with reference to Figures 4A to 4C and Figure 5 of the accompanying drawings.

41. A silicon implant substantially as described herein with reference to Figure 6, or Figure 7, or Figure 8, or Figure 9 of the accompanying drawings.

42. A method of making a silicon implant for the delivery of a beneficial substance to a subject, the method comprising taking a body of silicon, forming the silicon into an implantable implant. and introducing a beneficial substance into the silicon.

43. A method according to claim 42 which comprises applying a solution of micromineral to the silicon and migrating the micromineral into the silicon.

44. A method according to claim 42 ~~or claim 43~~ comprising driving the beneficial substance into the silicon using heat.

45. A method according to claim 42 ~~any one of claims 42 to 44~~ comprising micromachining a hole or recess in the silicon.

46. A method according to claim 45 further comprising introducing said beneficial substance into the hole.

47. A method according to claim 43 ~~any one of claims 43 to 46~~ comprising applying a lid, or door, over the region which contains the beneficial substance to retain the beneficial substance.

48. A method according to claim 45 ~~any one of claims 45 to 47~~ comprising making a hole in a first component of silicon, making a complementary hole in a second piece of silicon, introducing said beneficial substance into one or both holes, and joining the two components together with their holes in register to define a closed reservoir which contains said beneficial substance.

49. A method according to claim 45 ~~any one of claims 45 to 48~~ comprising making a large number of holes in the implant, preferably simultaneously.

50. A method according to claim 49 which uses a photolithographic technique to make the holes.

54 Claim 42

51. A method according to ~~any one of claims 42 to 50~~ comprising treating the body of silicon to make at least part of it porous.

52. A method according to claim 51 comprising making a body of silicon porous throughout substantially the whole of its volume.

Claim 42

53. A method according to ~~any one of claims 42 to 50~~ comprising taking, or creating, a polycrystalline silicon body of material, or a layer or region of polycrystalline silicon.

54. A method of making a semiconductor implant for the delivery of a beneficial substance to a subject, the method comprising taking a body of semiconductor, forming the semiconductor into an implantable implant, and introducing a beneficial substance into the semiconductor. implant?

55. A method according to claim 54 in which the semiconductor is from the group: silicon, germanium.

56. A method according to claim 54 ~~or claim 55~~ comprising introducing a micromineral to the semiconductor.

Claim 54

57. or A method according to ~~any one of claims 54 to 56~~ and in accordance with any one of claims 42 to 53, in which the silicon material need not be silicon but could be another semiconductor.

58. A method of making a semiconductor implant substantially as described herein.

59. A method of making an implant for the delivery of beneficial substance to a subject. the method comprising treating a porous member of

material that is erodable in vivo, creating an implant from the member, and introducing a beneficial substance into the implant.

60. An implant having a plurality of reservoirs, a plurality of beneficial substance charges provided in said reservoirs, and a plurality of barrier regions, or doors, provided adjacent said reservoirs, the doors having a plurality of different erosion times when implanted, the arrangement being such that in use the doors are broken down sequentially in order to stagger the release of the contents of the reservoirs.

61. An implant according to claim 60 in which the doors comprise a semiconductor material.

62. An implant according to claim 60 ~~or claim 61 in~~ which substantially the entire implant comprises semiconductor material.

63. An implant according to claim 62 in which the implant comprises the same semiconductor material throughout.

64. An implant according to claim 60 ~~any one of claims 60 to 63~~ in which there are at least five reservoirs.

65. An implant according to claim 64 in which there are at least ten reservoirs.

66. An implant according to claim 64 in which there are at least fifty reservoirs.

67. An implant according to claim 64 in which there are at least one hundred reservoirs.

68. An implant according to claim 64 in which there are at least of the order of hundreds of reservoirs.

69. A method of delivering a beneficial substance to a subject comprising implanting an implant into the subject and arranging for different regions of the implant to be eroded through or away at different times by arranging for said regions to require different exposure times to the corroding fluids experienced in use to be breached, and using the sequential breaching of said different regions to release sequentially different reservoirs of beneficial substance that were retained in or behind said different regions of the implant.

70. The use of corrodable ~~or~~ resorbable silicon, or other semiconductor material, in the preparation of an implant for the delivery of a physiologically active substance to a subject.

71. The use of the corrosion or resorbtion of silicon or other semiconductor material in an implant in order to release a substance entrained in the material of the silicon or semiconductor, or to open a door to a reservoir of the substance.

72 A silicon implant according to Claim 6 ~~any one of Claims 6, 7, 9, 10, and 11~~ characterised in that the implant comprises a porous silicon sample having a sample surface, the element being present at a concentration between 1 and 90 atomic percent at a depth, from the sample surface, between 0.35μm and 1000μm.

73 A silicon implant according to Claim 72 characterised in that the element is present at a concentration between 1 and 50 atomic percent at a depth, from the sample surface, between 0.35 μm and 100μm.

74 A silicon implant according to Claim 72 characterised in that the element is present at a concentration between 1 and 10 atomic percent at a depth, from the sample surface, between 0.35 μm and 100μm.

75 A silicon implant according to Claim 72 characterised in that the element is present at a concentration between 1 and 10 atomic percent at a depth, from the sample surface, between 20μm and 30μm.

76 A method according to Claim 54 characterised in that the method comprises the further step of treating the body of semiconductor to make at least part of it porous.

77 A method according to Claim 76 characterised in that the step of introducing the beneficial substance comprises the steps:

(a) bringing the beneficial substance into contact with the porous part of the semiconductor;

(b) causing the beneficial substance to be in a molten phase; and

(c) allowing the molten beneficial substance to pass into the porous part of the semiconductor.

78 A method according to Claim 77 characterised in that the passage of the beneficial substance into the porous semiconductor is assisted by the application of heat to the porous semiconductor.

79 A method according to Claim 77 characterised in that the method further comprises the step of thermally decomposing the beneficial substance that has passed into the porous semiconducting material.

80 A method according to Claim 77 characterised in that the method comprises the step of reacting the beneficial substance that has passed into the semiconductor material with an oxidant.

81 A method according to Claim 76 ~~any one of Claims 76 to 80~~ characterised in that the semiconductor is silicon.

82 A method of impregnating a porous semiconducting material with an impregnate substance, the method comprising the step of bringing the impregnate substance into contact with the porous semiconducting material; characterised in that the method further comprises the steps:

(a) causing the impregnate substance to be in a molten phase; and
(b) allowing the molten impregnate substance to pass into the porous semiconducting material.

83 A method according to Claim 82 characterised in that the passage of the impregnate substance into the porous semiconductor is assisted by the application of heat to the porous semiconductor.

84 A method according to Claim 82 characterised in that the method further comprises the step of thermally decomposing the impregnate substance that has passed into the porous semiconducting material.

85 A method according to Claim 82 characterised in that the method comprises the step of reacting the impregnate substance that has passed into the semiconductor material with an oxidant.

Claim 82

86 A method according to ~~any one of Claims 82 to 85~~ characterised in that the impregnate substance comprises a metal salt.

87 A method according to Claim 86 characterised in that the impregnate substance comprises two or more metal salts.

88 A method according to Claim 86 characterised in that the metal salt is manganese nitrate or chromium nitrate or silver nitrate or calcium nitrate.

89 A method according to Claim 86 characterised in that the metal salt is a salt of one or more the transition metals or the rare earth metals.

90 A method according to Claim 86 characterised in that the salt is a nitrate or an alkoxide or a beta-diketone, or a mixed alkoxide/beta-diketone.

91 A method according to Claim 86 characterised in that the salt has a melting point less than 800 C.

92 A method according to Claim 86 characterised in that the salt has a melting point less than 400 C.

93 A method according to Claim 86 characterised in that the salt has a melting point between 0 C and 150 C.

Claim 82

94 A method according to ~~any one of Claims 82 to 93~~ characterised in that the porous semiconducting material is porous silicon.

95 A method according to Claim 94 characterised in that the porous silicon has a porosity in the range 3% to to 60%.

96 A sample of porous silicon that has been impregnated with an impregnate substance, the sample having a sample surface and the impregnate substance comprising an impregnate element. characterised in that the impregnate element is present at a concentration between 1 and 90 atomic percent at a depth, from the sample surface, between 0.35μm and 1000μm.

97 A sample according to Claim 96 characterised in that the impregnate element is present at a concentration between 1 and 50 atomic percent at a depth, from the sample surface, between 0.35 μm and 100μm.

98 A sample according to Claim 96 characterised in that the impregnate element is present at a concentration between 1 and 10 atomic percent at a depth, from the sample surface, between 0.35 μm and 100μm.

99 A sample according to Claim 96 characterised in that the impregnate element is present at a concentration between 1 and 10 atomic percent at a depth, from the sample surface, between 20μm and 30μm.

100 A sample according to ~~any one of Claims 96 to 99~~ Claim 96 characterised in that the impregnate element comprises a metal.

101 A sample according to Claim 100 characterised in that the metal is manganese, chromium, silver or calcium.

102 A sample according to Claim 100 characterised in that the metal is a transition metal or a rare earth metal

103 A method according to Claim 77 ~~any one of Claims 77 to 81~~ characterised in that the beneficial substance substantially consists of a metal salt.

104 A method according to Claim 77 ~~any one of Claims 77 to 81~~ characterised in that the beneficial substance substantially consists of a mixture of two or more metal salts.

105 A method according to Claim 77 ~~any one of Claims 77 to 81~~ characterised in that the beneficial substance is a solid at 293 K and 760 mmHg.

106 A method according to Claim 82 ~~any one of Claims 82 to 86~~ or any one of Claims 88 to 93 characterised in that the impregnate substance substantially consists of a metal salt.

107 A method according to any one of Claims 87 characterised in that the impregnate substance substantially consists of a mixture of two or more metal salts.

108 A method according to Claim 82 ~~any one of Claims 82 to 85~~ characterised in that the impregnate substance is a solid at 293 K and 760 mmHg.

109 A silicon implant according to Claim 73 characterised in that the element is present at a concentration between 1 and 50 atomic percent at a depth, from the sample surface, between 10 μm and 100μm.

110 A silicon implant according to Claim 74 characterised in that the element is present at a concentration between 1 and 10 atomic percent at a depth, from the sample surface, between 10 μm and 100μm.

111 A sample according to Claim 97 characterised in that the impregnate element is present at a concentration between 1 and 50 atomic percent at a depth, from the sample surface, between 10 μm and 100μm.

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112 A sample according to Claim 98 characterised in that the impregnate element is present at a concentration between 1 and 10 atomic percent at a depth, from the sample surface, between 10 μm and 100μm.

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